MathWorlds

Detective Agency Copy Masters

Reidmore Books

Detective Agency

Lettering for Naming Detective Agency
Copy Master Intro.A

Agency Note Board

Assembly Agenda
Copy Master Intro.B

Thought of the Day

Call to Meeting

at_____

on _____ **, 199**__

Agenda:

_____

_____

_____

_____

_____

_____

_____

_____

_____

Copy Master:
Polygon Cutouts and Games

Student _____

Events-Based Record Keeping Chart

Event	Product(s)	Group Skills	Work Skills
Lesson 1–1: *Seeing with your hands*			
Lesson 1–2: *Seeing too much*			
Lesson 1–3: *Seeing through shape*			
Lesson 1–5: *Seeing through arms and legs*			

Student _____

Objectives-Based Record Keeping Chart

Dates Observed	Objectives
	G8. classifies 3–D objects by using objects to name prisms, pyramids, cones, cylinders, spheres
	D13. constructs graphs
	P21. does a simpler but related problem (constructs a model)
	M15. uses appropriate standard measuring units for length

The Vowel Gang

Slowly, with shaking fingers, he climbed over the three metre iron railings enclosing the property. He had a good idea that there were no dogs or security alarms that would give warning of his intrusion. Nevertheless, he had to force himself to be patient, not to rush and do something stupid. Still his hands quivered as he gripped the cold iron.

A small light flickered in one of the windows facing the railing. Or was it his imagination? This was awful! Now he was seeing things that just weren't there. But there it was again. Was someone looking at him perched on top of the fence? He felt like jumping off and running away. There was no one there. How could there be? No one was supposed to be home.

The moon peeked out from behind the cloud. He felt naked, like a sitting duck in a shooting gallery. Quickly he slid down the other side of the railing glad to have his feet firmly on the ground. He tiptoed round the mansion trying not to make any noise, finally coming to a stop under the basement window which he knew was left unlocked.

***

Exhibition 1–3: Seeing Square Numbers

Seeing is believing—Would the real square numbers please step forward!

1. Legend has it that square numbers are pretty square. If you were to interview adults about square numbers, most of them would tell you that it is **obvious** that:

   - the square numbers are

     1 x 1 = 1
     2 x 2 = 4
     3 x 3 = 9
     4 x 4 = 16 ...and so on.

2. Unknown to most adults is the surprising fact that these numbers often go about in **disguise.**

The Problem: To find out what square numbers *really* look like.

To get the investigation started:

- This presentation provides 3 Exhibits of information.
- Each Exhibit provides different evidence about the real shape of "square numbers."
- The evidence provided in each Exhibit is incomplete.
- Overall the evidence is somewhat confusing.

In order to solve the problem, consider the evidence, complete it where necessary, analyze the evidence, use your powerful intelligence, come up with some answers.

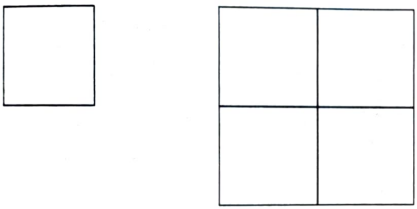
Extra challenge: Can square numbers disguise themselves as pentagons, hexagons, octagons, or parallelograms?

Exhibit 1–3a: Seeing Square Numbers as Squares

The first two square numbers are 1 and 4, and the exhibit shows them looking very square.

Complete the sketches for the next two square numbers to satisfy yourself that they are square too.

1 4 9 16



Are these the **real** square numbers, or are they just disguised to make them look square?

Exhibit 1–3b: Seeing Square Numbers as Triangular

1 4 9 16

So, are the square numbers **really** square? Or are they triangular? What do square numbers really look like? Which is the disguise?

Exhibit 1–3c: The *Real* Square Numbers are Trapezoidal

This Exhibit shows the square numbers in trapezoidal clothing because they really are trapezoidal! (But be careful — more than one detective has fallen for false evidence! Or failed to recognize the truth staring him/her in the face!) How would the other square numbers look in trapezoidal clothing?

1 4 9 16

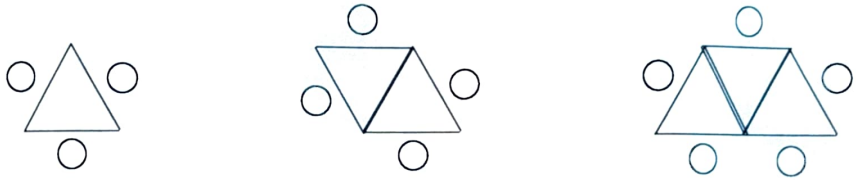
Now back to the problem: Would the real square numbers please step forward!

As number detectives who can see beneath "facial" appearances, how can you solve this problem? Are the square numbers really square? Are they masters of disguise? What is real? What is disguise? How can a detective see through "appearances?"

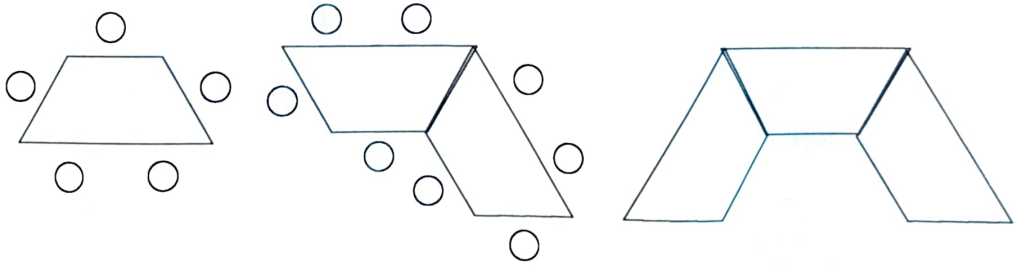
Seeing with Chairs

Jerry's Java Joint is having hard times — people just aren't stopping in to chat and have coffee. Jerry is convinced that the seating arrangements in his joint are the problem. He has been looking at some creative table shapes — triangular and trapezoidal, parallelogram shaped, hexagonal — as well as the traditional square.

He is thinking of installing tables built up from placing single tables side by side. For example, tables built up by placing triangle tables side by side could look like this:



Tables built up out of trapezoids might look like this:



He is thinking of more complicated tables as well, although an 18-chair table is about as big as he would like to go. He is interested in tables that would seat from 4 to 18 people.

Investigative problem:
- What are the possible tables he could try?
- Which of these tables would you recommend?

Getting started:
- Make a plan for starting your investigation
- Check it out with the Chief Detective

Guiding question:
- How can you visualize the tables? Would your cardboard cut-outs help?

Calculating Mileage

Description:

1. Sometimes detectives solve very routine problems like finding out how many kilometres they drive in a week because the agency covers their driving expenses. Detective Drivenlee has been working on several cases which means she has had to drive between several towns near her agency. A good detective, she has a clear map of the area (Exhibit 2-1A: Route Map).

2. Last week her note book contained these entries:
   - Wolf to Madison
   - Madison to Palma
   - Palma to Sedworth
   - Sedworth to Underhill
   - Underhill to Timber
   - Timber to Wolf

4. If her agency pays 1 cent for every 100 metres driven, how much should she be paid to cover the costs of her driving last week?

3. Where is her agency located?

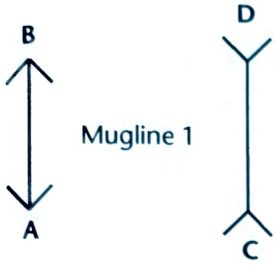
Investigation Tools:

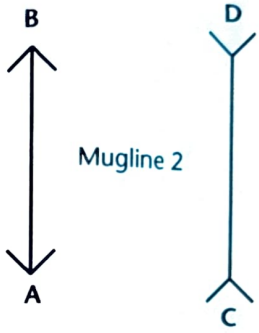
1. Exhibit 2-1A: Route Map
2. ruler
3. calculator (optional)

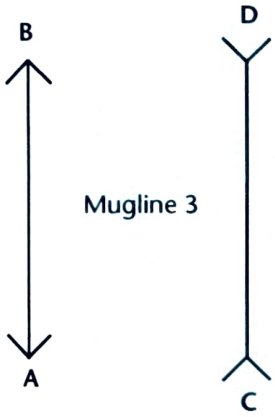
Seeing Through Arms and Legs

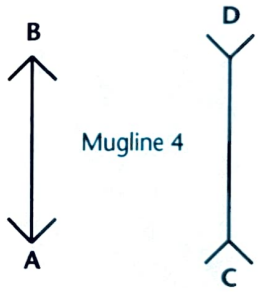
In order to make accurate descriptions, detectives need to be able to estimate heights, distances, weight, size, and so on with accuracy. They must be able to detect even small differences in size.

Test out the keeness of your vision. In each scene two stick men are presented. Your job is to determine by looking which one has the longer body. They are trying their best to distract you by waving their arms and legs!









Test out the accuracy of your eyes by using a ruler. Record your observations.

Mugline 1: Length of body segment AB _____ Length of body segment CD _____

Mugline 2: Length of body segment AB _____ Length of body segment CD _____

Mugline 3: Length of body segment AB _____ Length of body segment CD _____

Mugline 4: Length of body segment AB _____ Length of body segment CD _____

What conclusions can you draw from this case?

How can this case help to make us better detectives?

Mugline Game

Detectives will have made many valid and many invalid nets for the hexahedron. These can be used to play a "Mugline Game."

If detectives are grouped into teams of 4 or 5, then each team can select a set of 4 or 5 nets only one of which is valid. Teams can then take turns forming a "Mugline" at the front of the room with each team member holding a net. The task for the rest of the teams is to decide which Mugline member is holding a hexahedron in disguise.

"What's My Mugline?"

Materials

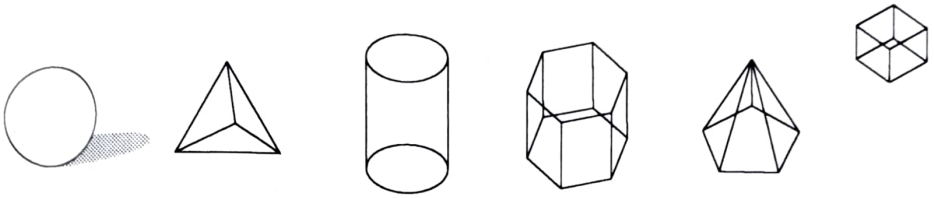
- A collection of BlockHeads (approximately 12)
- A set of cards showing sketches of six BlockHeads arranged in a Mugline (approximately 15)

Directions

One detective selects a card showing a mugline and the other has a set of Blockheads. The detective with the card tries to communicate information to the other detective so that he or she can arrange the BlockHeads into the same Mugline as shown on the card. The only information that can be given is information about edges, vertices, and faces.
E.g., *"The first BlockHead in the line has 6 square faces and each vertex is a square corner."*

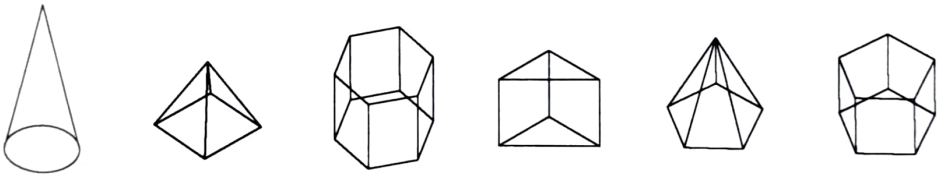
This activity could be turned into a game somewhat like *Pictionary* where two teams play against each other to see which can form the Mugline first.

Pyramids	Prisms	Cones	Cylinders	Others
triangle based pyramid	triangle based prisim	any	any	octahedron
square based pyramid	square based prisim			sphere
pentagonal based pyramid	pentagonal based prisim			ellipsoid
hexagonal based pyramid	hexagonal based prisim			
	rectangular based prisim			



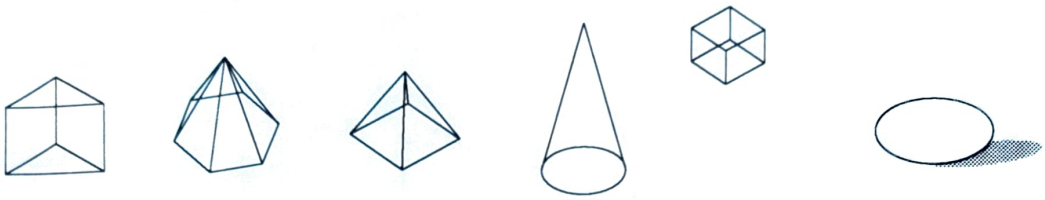
1 2 3 4 5 6

Mugline Card 1



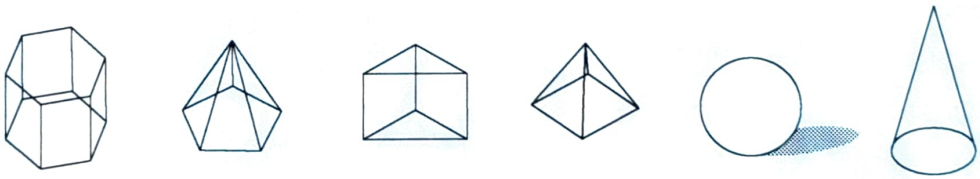
1 2 3 4 5 6

Mugline Card 2



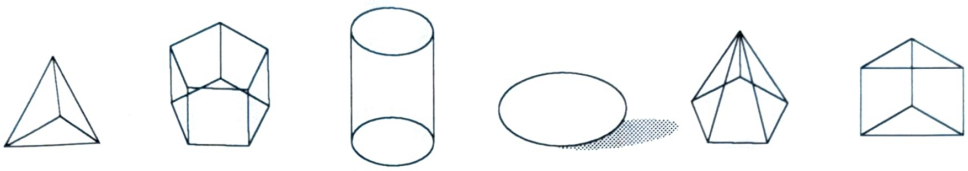
1 2 3 4 5 6

Mugline Card 3



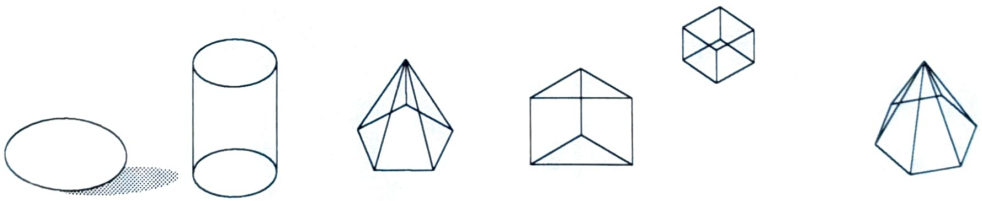
1 2 3 4 5 6

Mugline Card 4



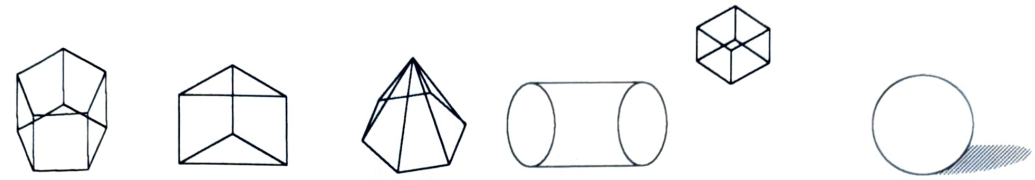
1 2 3 4 5 6

Mugline Card 7



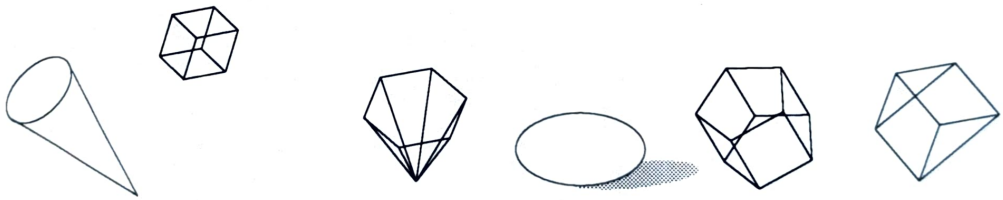
1 2 3 4 5 6

Mugline Card 8



1 2 3 4 5 6

Mugline Card 9



1 2 3 4 5 6

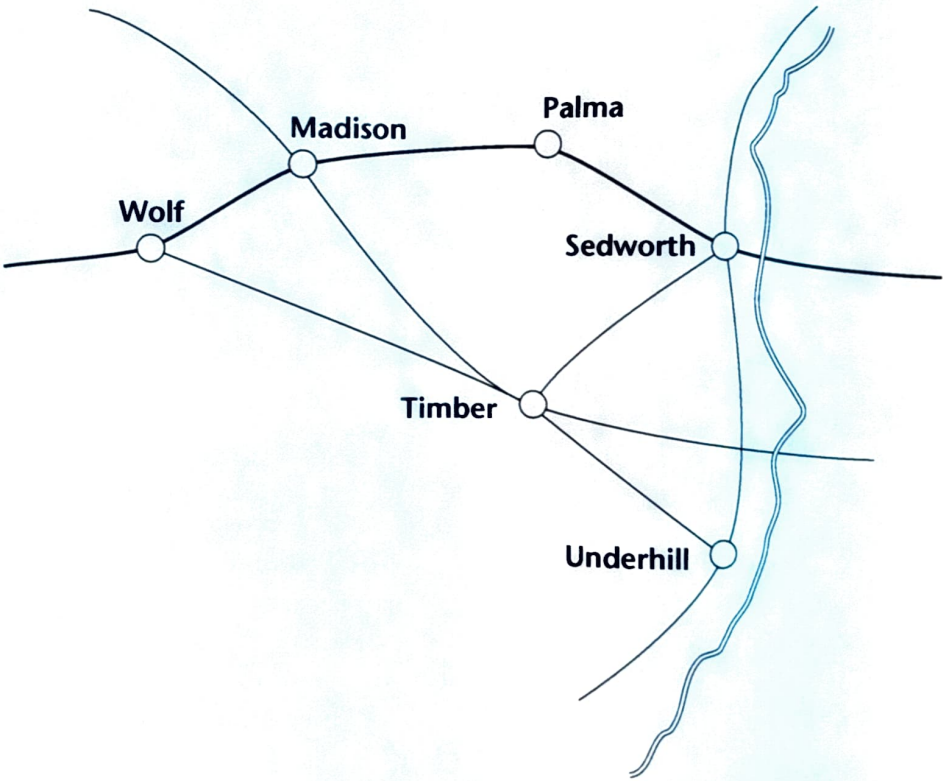
Mugline Card 10

Student _____

Events-Based Record Keeping Chart

Event	Product(s)	Group Skills	Work Skills
Lesson 2–1: *Calculating mileage*			
Lesson 2–2: *Sabotage at the Ice Cream Plant*			
Lesson 2–3: *Check the Cashiers*			
Lesson 2–5 ... *Optional cases*			

Route Map



Sabotage at the Ice Cream Plant

Description:

1. The Ice Cream bandit was at it again. He hates ice cream and just hates seeing kids enjoying a double scoop of wild blueberry ice cream. He hates it even more when they smack their lips. Last night he was at work again trying to spoil the ice cream at the Ice Cream Plant. The investigating officer responded to a call last night just after midnight. He had scribbled rough notes as follows:

   "Arrived at the Plant shortly after midnight at 00 15 58.

   Each ice cream Vat had been shut down - the power switches were each shut off.

   The thermometers in each Vat had different readings. Must remember to photograph each thermometer with my infrared camera because it is too dark to accurately read each one.

   I wonder - Can I figure out the path the Bandit took as he went from one vat to another? If so I may be able to figure out which door was likely left unlocked."

2. Exhibit 2-2A1: "Melting Ice Cream" shows the sketches made from the photos of the thermometers. Exhibit 2-2A2: "Layout of the Ice Cream Vats" shows the location of the Vats in the Plant. What path did the Bandit take through the plant?

3. Which entry did he likely use to get in?

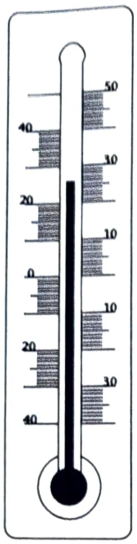
4. If he was in a hurry, which entrance did he likely leave by?

Investigation Tools:

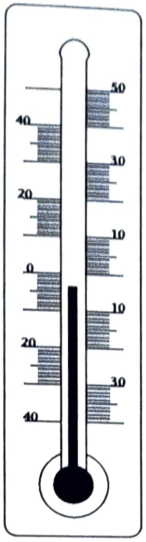
1. **Exhibit 2-2A1** *Melting Ice Cream*
2. **Exhibit 2-2A2** *Layout of the Ice Cream Vats*

Melting Ice Cream

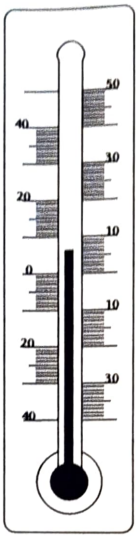
Chocolate



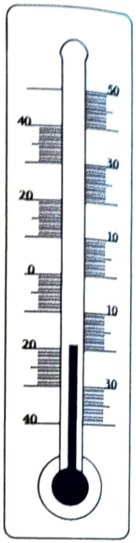
Strawberry



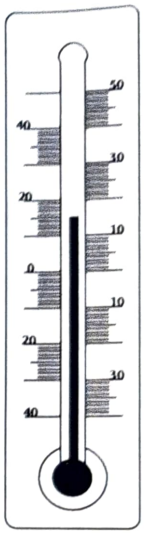
Butterscotch



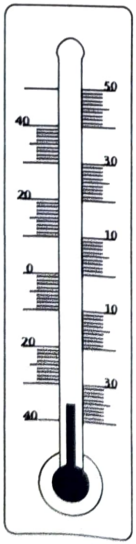
Vanilla



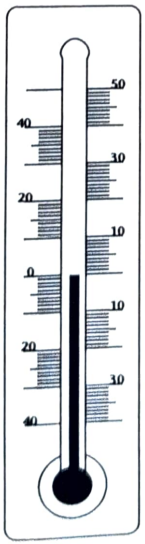
Tiger



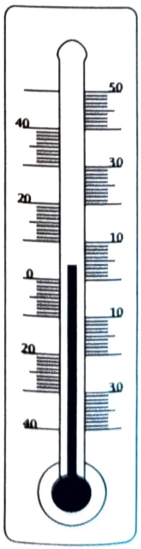
Orange



Rainbow



Bubble Gum



Turtle

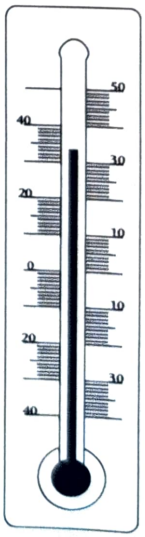
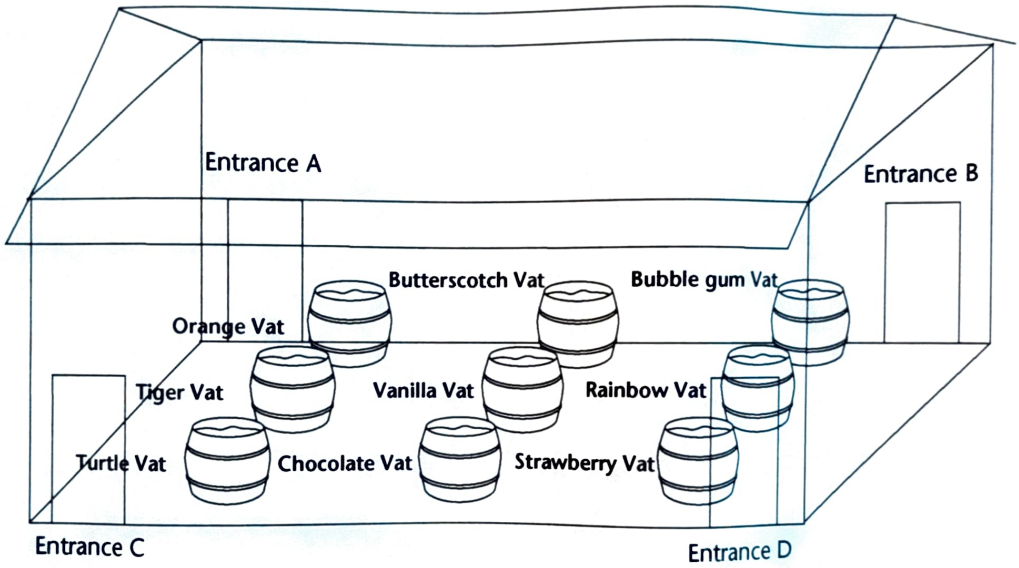


Exhibit 2–2B

Layout of Ice Cream Vats



Case Report Form

Case # _____ Client / Case Name: _____ Date: _____

Detective(s):

Time in: _____ Time out: _____ Time on case: _____

Include:
- Description of investigation (What I did)
- Significant discoveries / solutions / conclusions
- Questions and concerns (as yet unresolved / unresolvable)
- Further investigations recommended

Signature(s): _____ _____
(Detective) (Chief Detective)

Student _____

Objectives-Based Record Keeping Chart

Dates Observed	Objectives
	M–27. estimates and measures mass (grams)
	M–29. uses appropriate standard measuring units for mass: g
	M–35. reads the Celsius thermometer, and uses the symbol °C
	M–36. determines the reasonableness of Celsius thermometer readings in a situation
	P–13. knows what information is extraneous
	P–24. works problem backwards

Check the Cashiers

Description:

1. The owner of the local corner grocery store has contacted us. At the end of the day there always seems to be a shortage of cash in the till. Two cashiers work at the store. They both seem honest but mistakes are being made (hopefully not on purpose). Random checking of their handling of sales has produced a record of transactions (See "Evidence Sheet"). Do these slips tell us anything about what might be going wrong?

Investigation Tools:

1. **Evidence Sheet 2-3A** (2 pages): *Cashier Transactions*
2 Calculators (optional)

Cashier Transactions

Teller 1		Money given	Change
ketchup	$2.69	$6.00	2 pennies
tuna	$1.49		1 nickel
juice	$ .99		3 quarters
TOTAL:	$5.17		

apples	$1.49	$6.00	4 pennies
peanuts	$1.49		1 nickel
muffins	$1.09		1 dime
onions	$1.49		1 quarter
TOTAL:	$5.56		

eggs	$1.49	$10.00	4 pennies
ice cream	$1.29		2 dimes
oil	$3.49		
detergent	$3.49		
TOTAL:	$9.76		

grapes	$ .89	$10.00	1 nickel
oranges	$1.28		1 dime
bread	$1.59		3 loonies
cake	$3.09		
TOTAL:	$6.85		

Cashier Transactions

Teller 2		Money given	Change
buns	$2.99	$10.00	3 pennies
wieners	$1.49		1 quarter
soap	$2.29		4 loonies
TOTAL:	$6.77		

ham	$1.19	$10.00	4 pennies
smokies	$.79		4 dimes
fish	$4.49		4 nickels
sausage	$.89		3 loonies
TOTAL:	$7.36		

dressing	$1.89	$10.00	8 pennies
honey	$3.45		3 dimes
radishes	$.89		1 quarter
cake	$3.09		1 nickel
TOTAL:	$9.32		

bags	$ 1.39	$10.00	4 pennies
crackers	$2.89		1 loony
cookies	$3.49		
salami	$1.19		
TOTAL:	$8.96		

Topping Down the Slurpy

Description:

1. Several customers have been complaining that a local slurpy dealer has been short-changing his thirsty customers by using containers that hold less than indicated. A selection of containers that he uses, each labeled as to size, has been gathered from his establishment. Is he an honest merchant?

Investigation Tools:

1. labeled containers
2. graduated cylinders
3. water

Case of the Mixed-Up Boxes

Description:

1. Our client, a Grade 5 teacher, Mr. McMillan, had prepared carefully for his mathematics lesson. He had divided a number of articles into two boxes. One box contained articles that weighed less than one gram; the other box contained articles that weighed more than one gram. When he arrived for class next day, the boxes had been overturned and the contents mixed together.

2. Mr. McMillan called in a request to our Detective Agency:
   a. Can we re-sort his boxes on time for his mathematics class?
   b. What would we be able to do to find out WHO did it?

Investigation Tools:

- scales to measure about one gram
- Exhibit 2-5A: Mixed-up Mathematics

Exhibit: Mixed-Up Mathematics

Less than one gram		More than one gram	
article	weight	article	weight

FlatHead Game

"What's My FlatHead?"

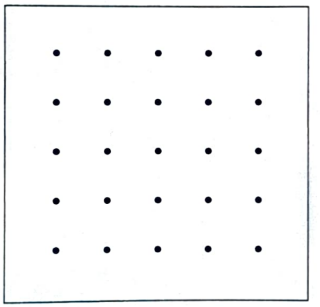
Materials

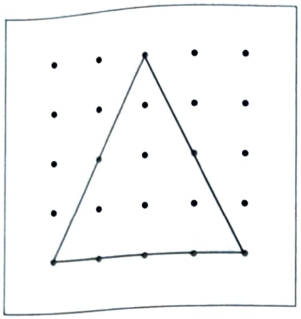
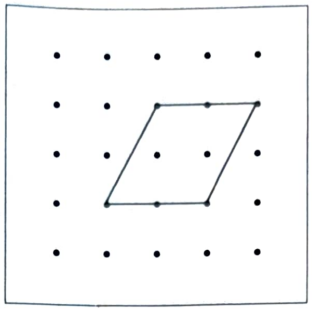
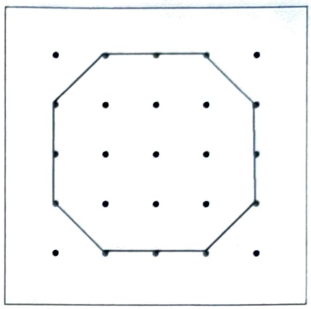
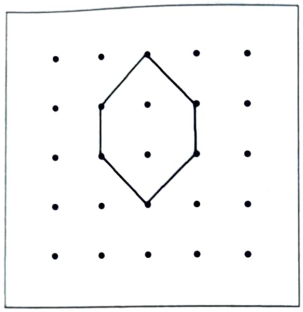
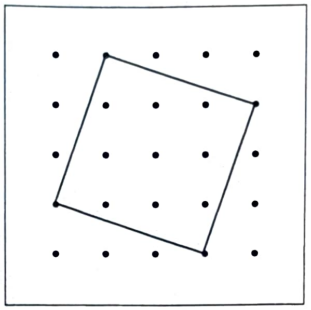
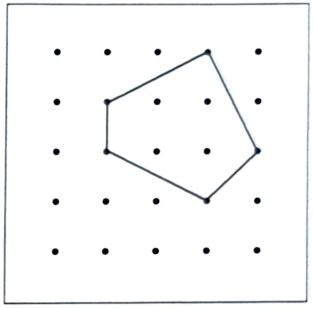
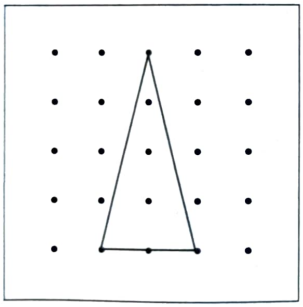
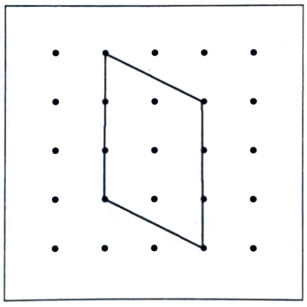
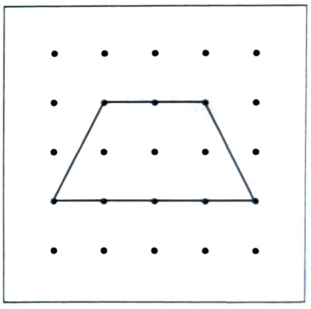
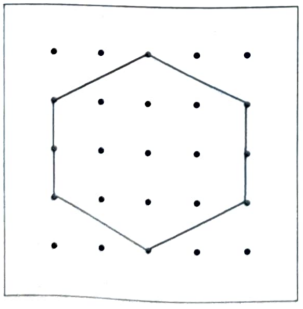
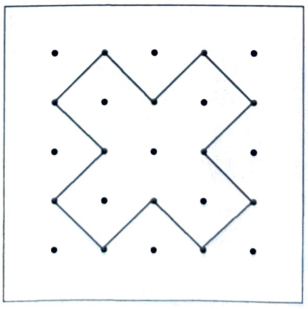
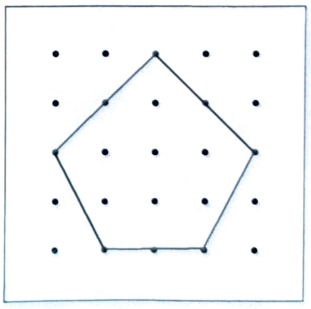
- geoboard and elastics
- cards showing a polygon (FlatHead) constructed on a geoboard

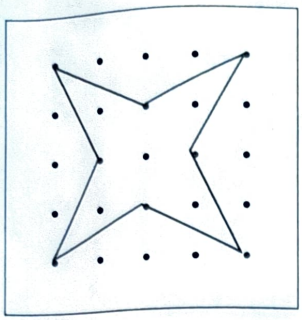
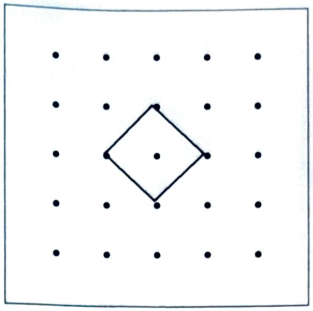
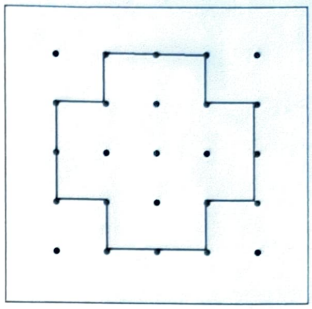
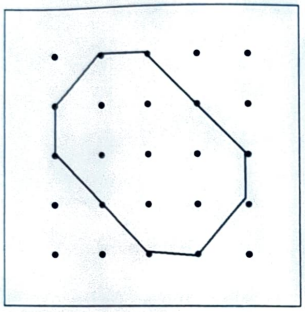
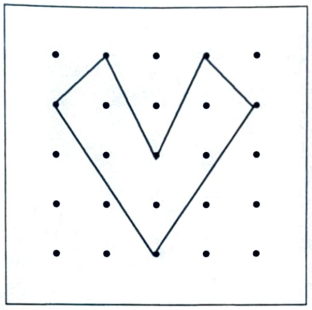
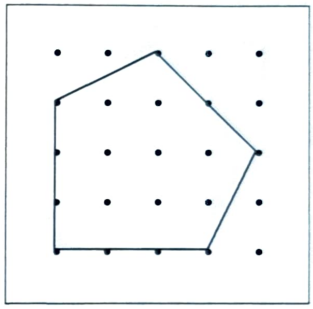
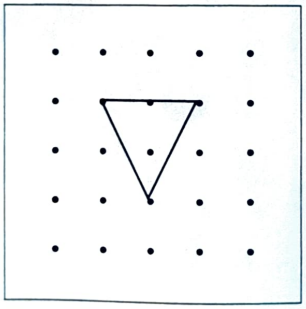
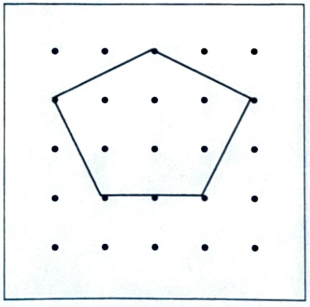
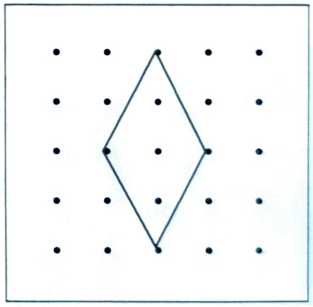
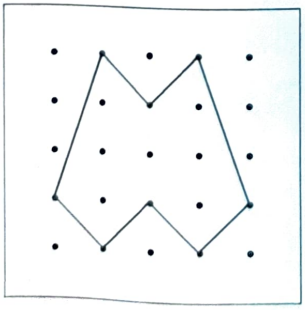
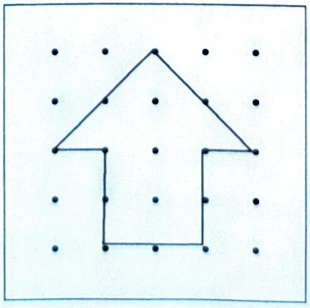
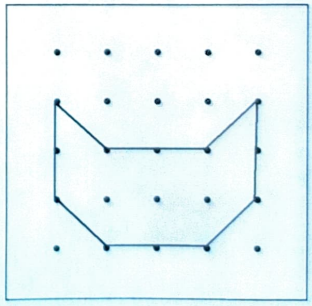
Directions

One detective selects a card, the other has a geoboard with elastics. The detective with the card gives descriptive information so that the other can construct the Flathead on the geoboard.

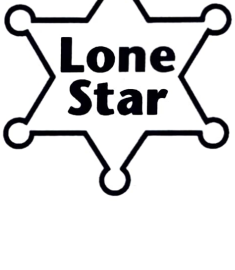
This activity could be organized as a game with teams somewhat like *Pictionary* where instead of drawing the item, the player must give verbal descriptions.



The Detective's Résumé



Student: _____

Events-Based Record Keeping Chart

Event	Product(s)	Group Skills	Work Skills
Lesson 3–1: *Wanted: Hexy*			
Lesson 3–2: *Capturing Blockheads*			
Lesson 3–3: *Cosmetic Surgery*			

Student: _____

Event	Product(s)	Group Skills	Work Skills
Lesson 3–4: *Mutilated Posters*			
Lesson 3–5: *Fastidious Frank Phelon*			
Lesson 3–6: *Balanced and Unbalanced Inmates*			
Lesson 3–7: *Leaders in Flathead Gangs*			

Student: _____

Event	Product(s)	Group Skills	Work Skills
Lesson 3–8: *Tanimals*			
Lesson 3–9: *Fastidious Frank Phelon*			
Lesson 3–10: *Guns and Bullets*			

Student: _____

Objectives-Based Record Keeping Chart

Dates Observed	Objectives
	M-8. reads and writes time, using standard notation to the nearest: second
	M-15. uses appropriate standard measuring units for length
	M-17. expresses linear measures to the nearest thousandth of a metre by using manipulatives, where appropriate
	M-29. uses appropriate standard measuring units for mass: kg, t
	M44. finds and compares the perimeter of polygons by using manipulatives and diagrams (no formulas) in a problem-solving setting
	M45. uses manipulatives and diagrams (no formulas) in a problem-solving setting to find and compare the area of rectangles
	M46. demonstrates understanding of the relationship between perimeter and area by using manipulatives and diagrams to make rectangles: • having the same perimeter but different areas • having the same area but different perimeters
	G-7. classifies and names two-dimensional figures as pentagons, hexagons, octagons
	G-8 using nets to name: prisms, pyramids according to the types of bases
	G-16. demonstrates understanding of symmetry through identifying symmetric figures and drawing lines of symmetry on two-dimensional figures
	G- 17. drawing and identifying translations (slides) of two-dimensional figures

Student: _____

Objectives-Based Record Keeping Chart

Dates Observed	Objectives
	G-18. demonstrates understanding of rotations (turns) by manipulating 2-dimensional figures
	P-1. demonstrates willingness to find a solution to a problem
	P-2. perseveres in finding a solution to a problem
	P-3. demonstrates flexibility in finding solutions to problems
	P-5. works both independently and in a group situation
	P-8. interprets pictures and diagrams
	P-10. restates the problem in own words
	P-11. knows what information is implied
	P-12. knows what information is missing
	P-13. knows what information is extraneous
	p-14. uses logical reasoning

Student: _____

Objectives-Based Record Keeping Chart

Dates Observed	Objectives
	P-17. looks for and continues patterns
	P-18. draws pictures and diagrams
	P-21. does a simpler but related problem
	P-24. works backwards
	P-25. states the answer(s) to the problem
	P-26. determines if the answer is reasonable
	P-27. discusses the solution process with others
	P-28. looks for other ways to solve the problem
	P-30. does similar problems
	P-31. alters the problem and finds the effect
	P-33. creates problems that exemplify the concepts learned.

Conference Report for Detective Achievement and Reference

Detective Name: _____ ID # _____

Conference #: _____ Case Sets Reviewed: _____ Date: _____

Focus of Conference: _____

_____

_____

Skills / Strategies / Capabilities Acquired and/or Extended: _____

_____

_____

_____

_____

Questions and Concerns (as yet unresolved / unresolvable): _____

_____

_____

General Commendations: _____

_____

_____

_____

Outstanding Achievement(s): _____

_____

Signature(s): _____ _____

Detective Chief Detective

Practice in Code-Breaking I

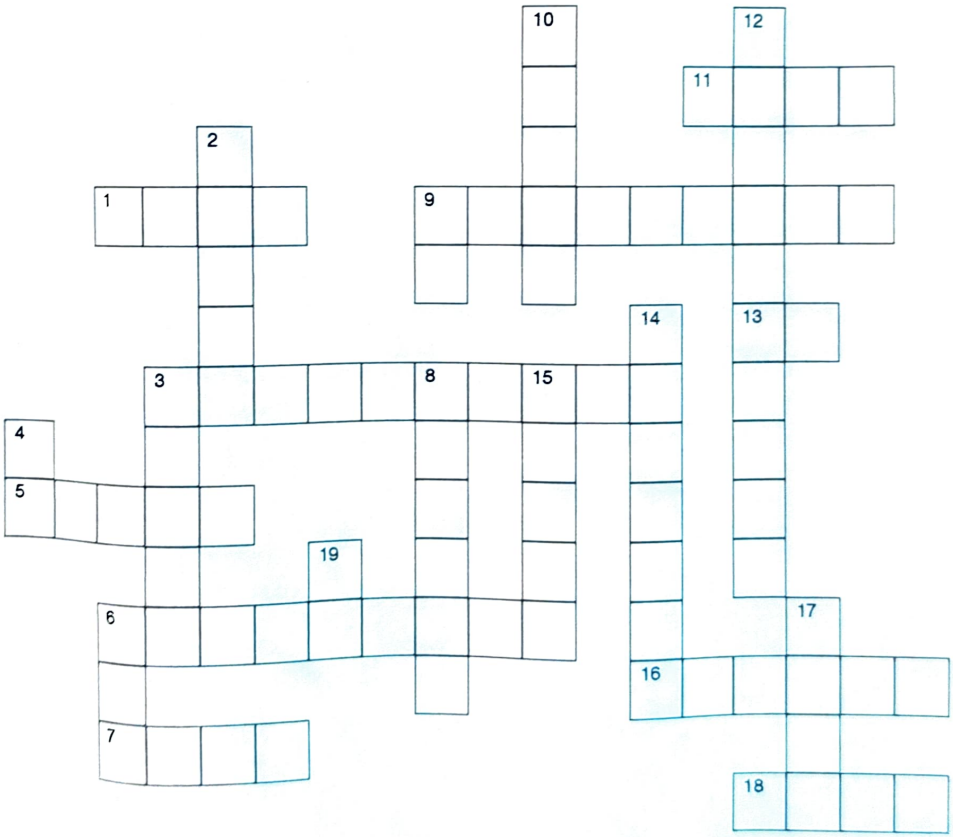
(A Measurement Crossword Puzzle)

Across

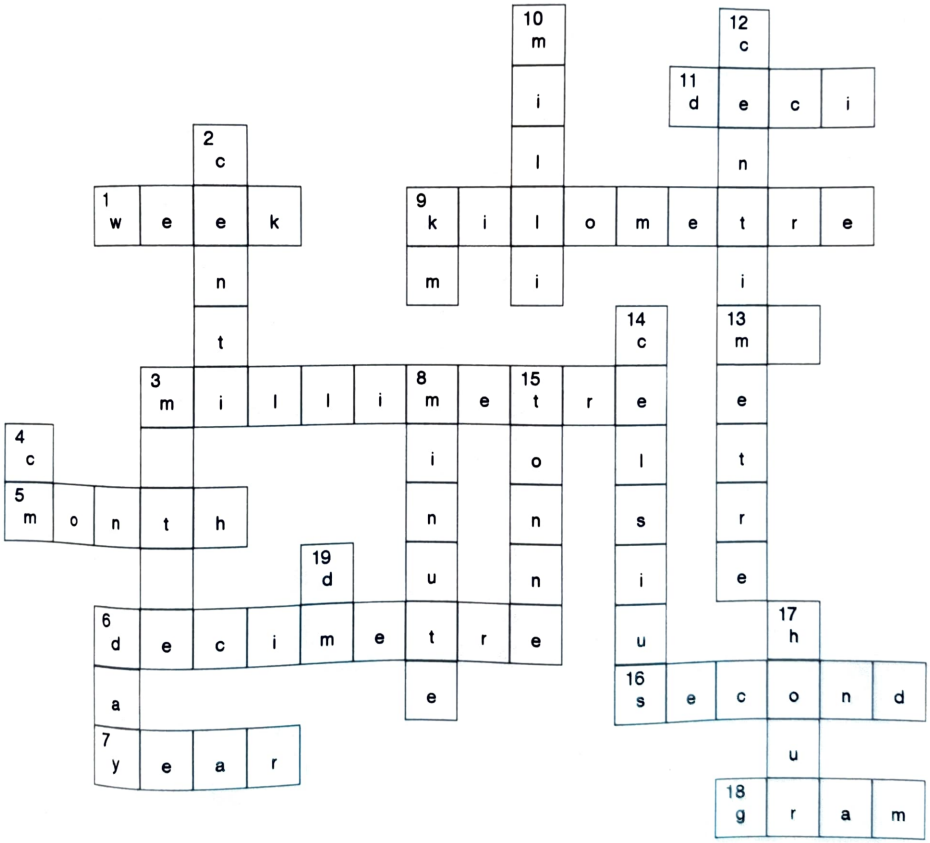
1. 7 days
3. 1000 of these in a metre
5. 12 in a year
6. takes 10 to make a metre
7. Leap ___
9. 1000 metres
11. one tenth of
13. millimetre
16. 3600 make an hour
18. standard unit for mass

Down

2. one hundredth of
3. standard unit for length
4. symbol for centimetre
6. from 28 to 31 in a month
8. 60 seconds
9. symbol for 1000 metres
10. one thousandth of
12. about the width of your index finger
14. temperature scale
15. 1000 kg
17. 24 in a day
19. ten cm



Key to Practice in Code-Breaking I



Practice in Code-Breaking II

(A Geometry Crossword Puzzle)

Across

1. like a pyramid with circular base
2. translation by simpler name
3. all its sides are rectangles
5. length around
6. a sophisticated cube
9. about half of a line
10. 5-sided polygon
11. a square has 4 lines of _____
13. many are polygons
14. many angles

Down

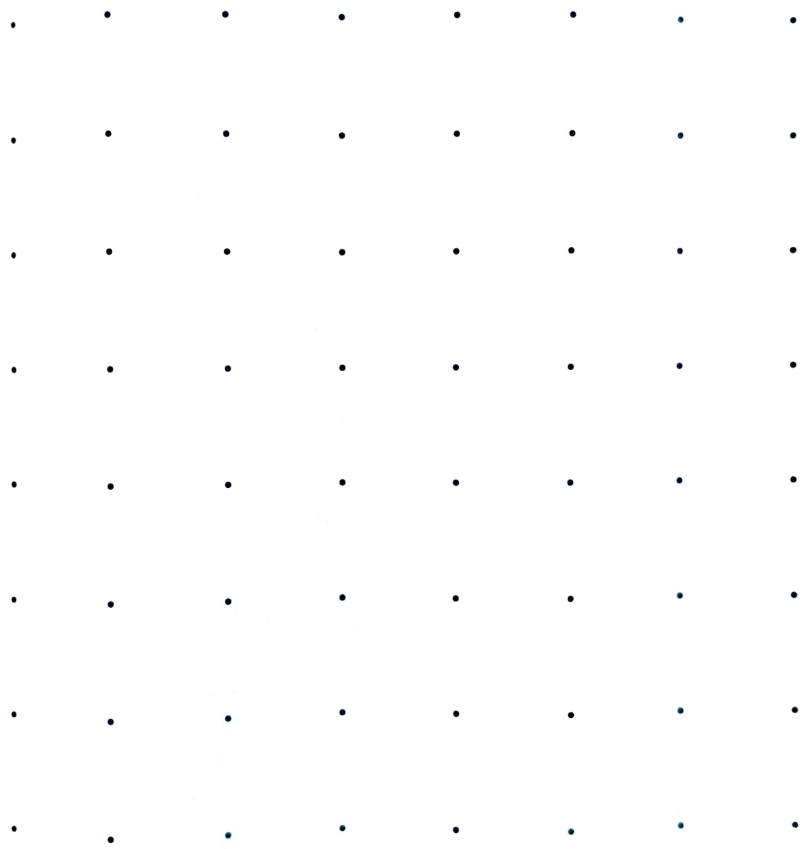
1. like a prism with circular bases
4. reflection by a shorter name
7. small part of a line
8. two rays back to back
9. more than one ray
10. all its sides are triangles
12. amount of surface
15. polygon with 8 angles
16. looks like a line segment
17. special set of Flat-Heads
18. _____s, edges, and vertices

Key to Practice in Code-Breaking I

Detective: _____

WANTED

The Hexahedron ("Hexy")

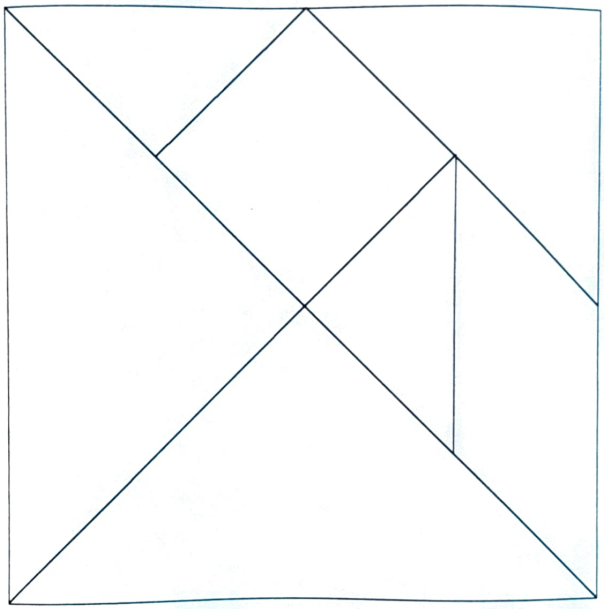


Description:

1. Number of edges: _____
2. Number of vertices: _____
3. Number of faces: _____
4. Other essential attributes: _____

Net Paper

TanGram FlatHeads



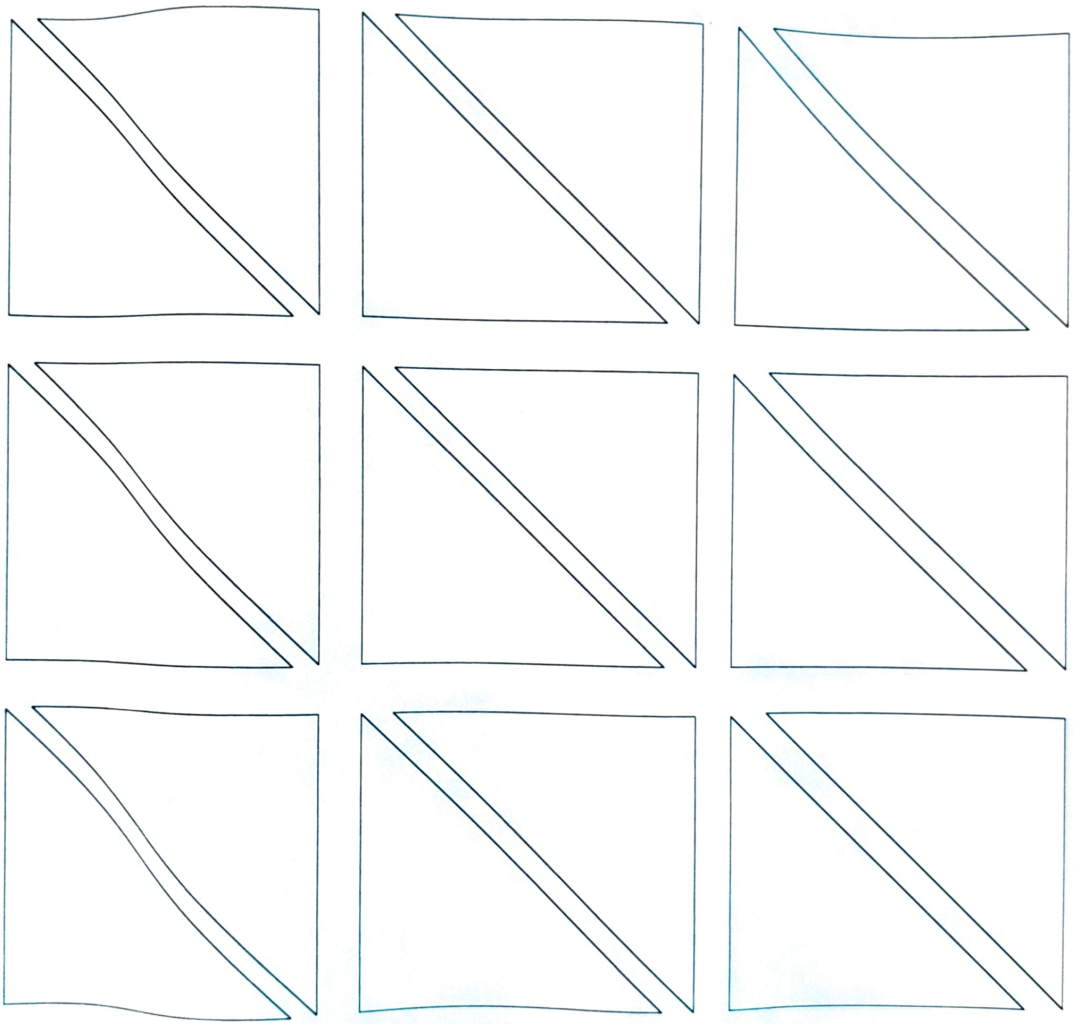
Instructions:

Use as a model to make a copy on heavy paper or tag board. Use a straight edge to cut into pieces along the solid lines and store in a small plastic bag or envelope labeled:

TanGram FlatHeads

Some FlatHead Triangles

(A Template To Make Paper Triangles)



Instructions:

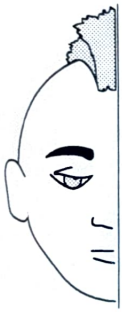
Cut out the triangles and store them in a small plastic bag or envelope labelled:

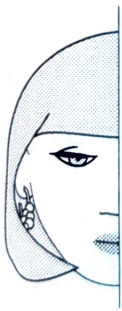
Some FlatHead Triangles

WANTED

DEAD OR ALIVE

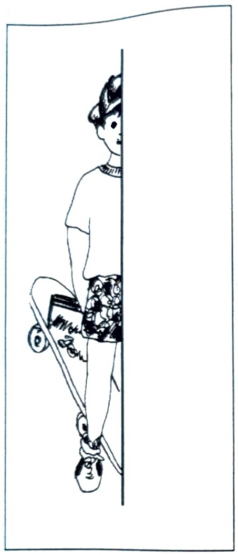
The James Gang

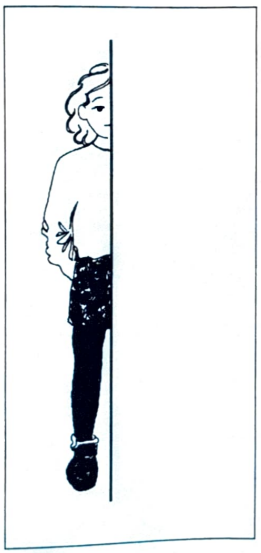


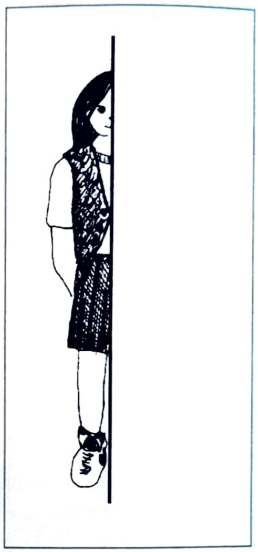


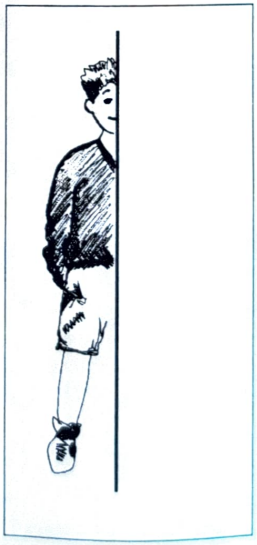
WANTED
DEAD OR ALIVE

The Gifford Gang





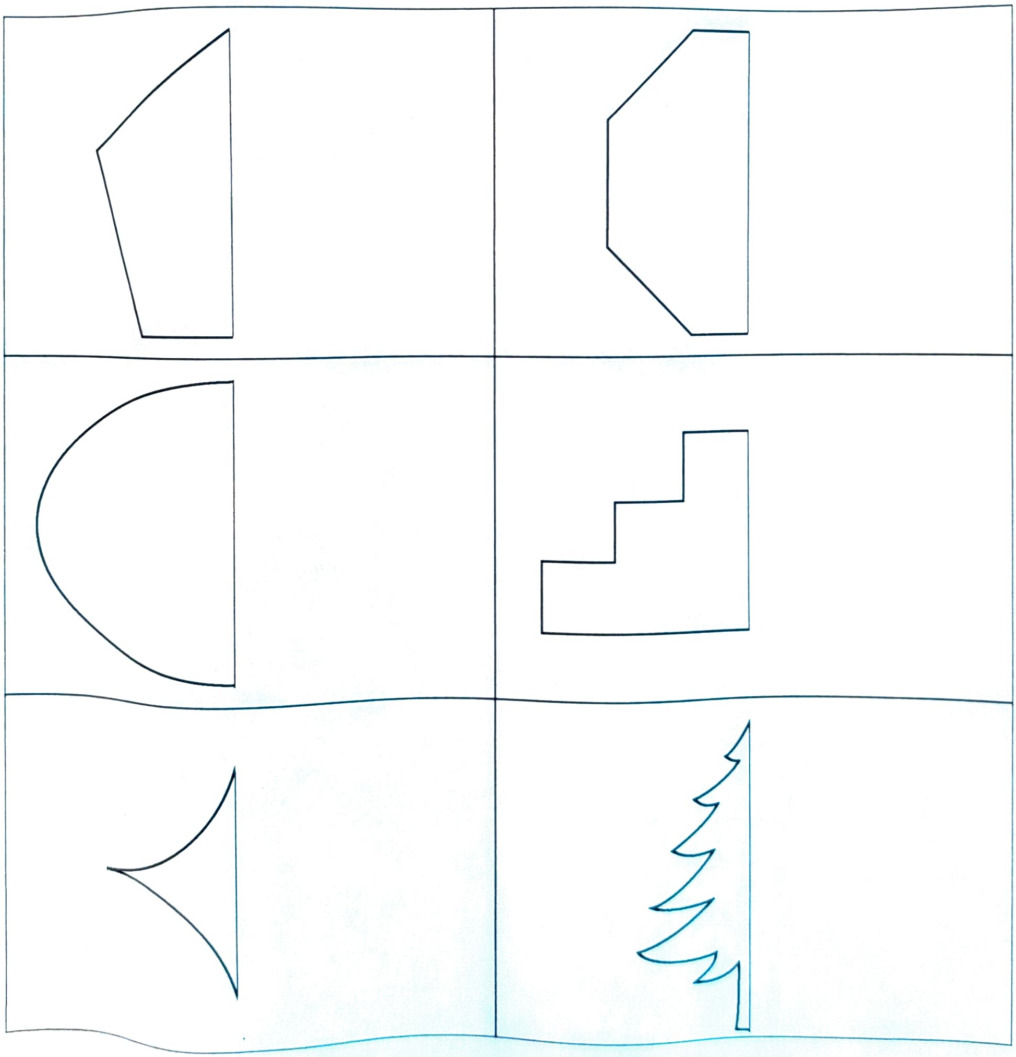




WANTED

DEAD OR ALIVE

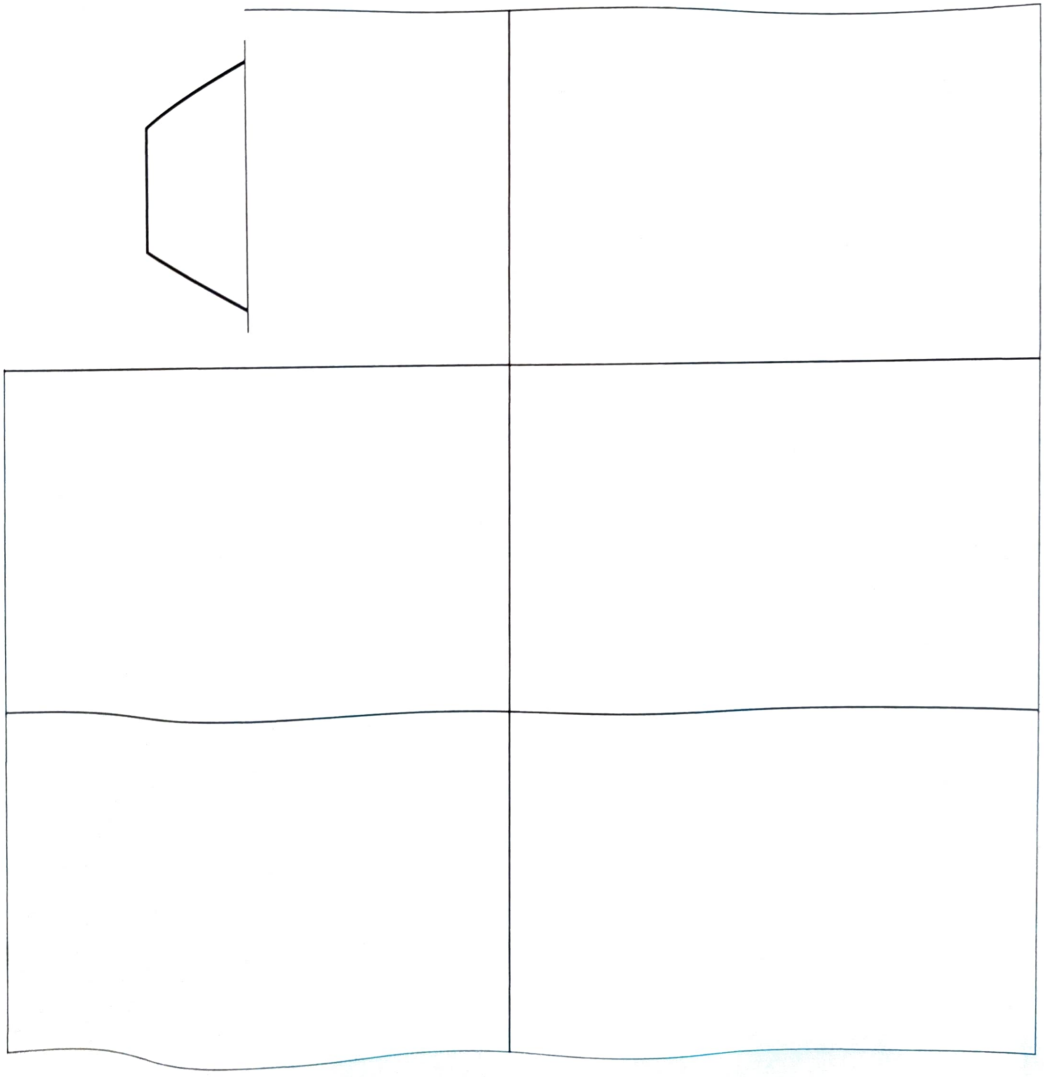
The Geo Gang



WANTED

DEAD OR ALIVE

The Hexagon



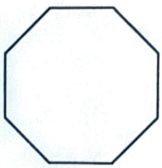
New FlatHeads

Cell Block _____

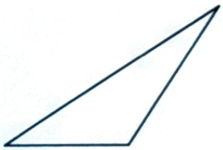
Cell Block _____

Cell Block _____

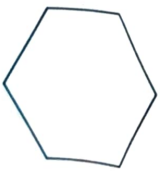
Cell Block _____



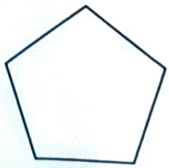
Cell Block _____



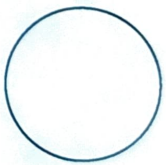
Cell Block _____



Cell Block _____



Cell Block _____



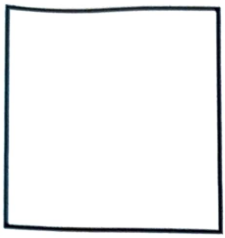
Cell Block _____

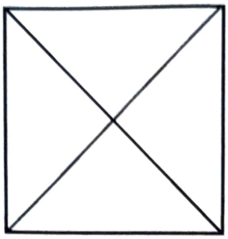
WANTED

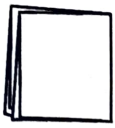
The Master Mind of All Master Minds

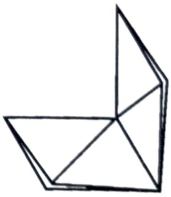
Tanimal Posters

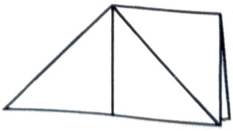
Origami Hexahedron

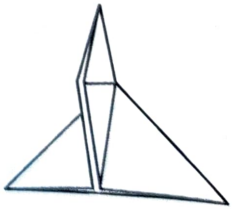








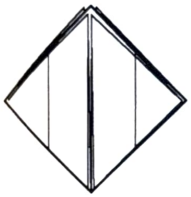




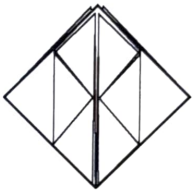
Origami Hexahedron (continued)

Fold bottom corners of the top layer up to the peak.

Turn the paper over and repeat last step. You should now have a square.



Fold each corner of the top layer into the centre creasing well.



Turn the paper over and repeat last step.

Fold small triangles down.

Fold the small triangles over top of the side triangles

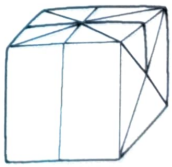
Unfold to last step.

Tuck small triangles into side triangles.

Turn paper over and repeat last four steps.

Fold left side of top layer to the right

turn paper over and repeat last step.



Blow carefully and gently into the hole and Voila!

Student _____

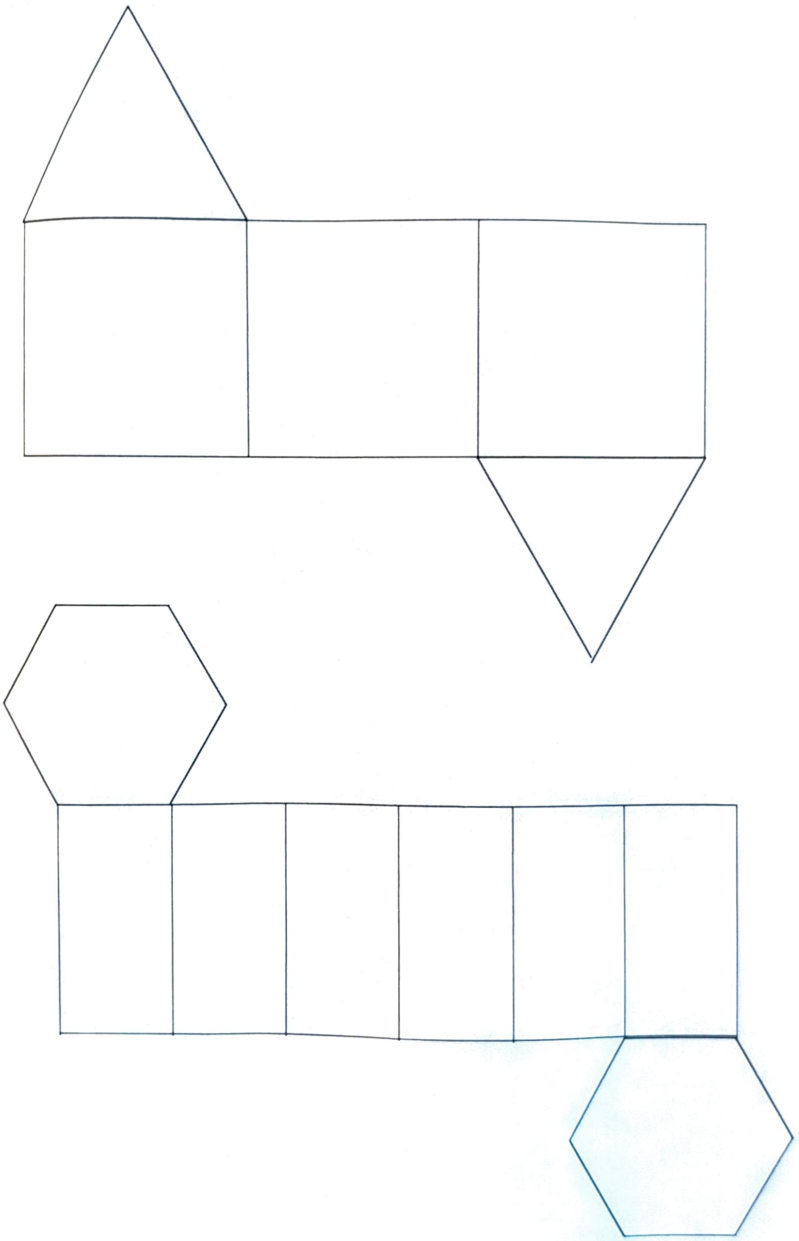
Events-Based Record Keeping Chart

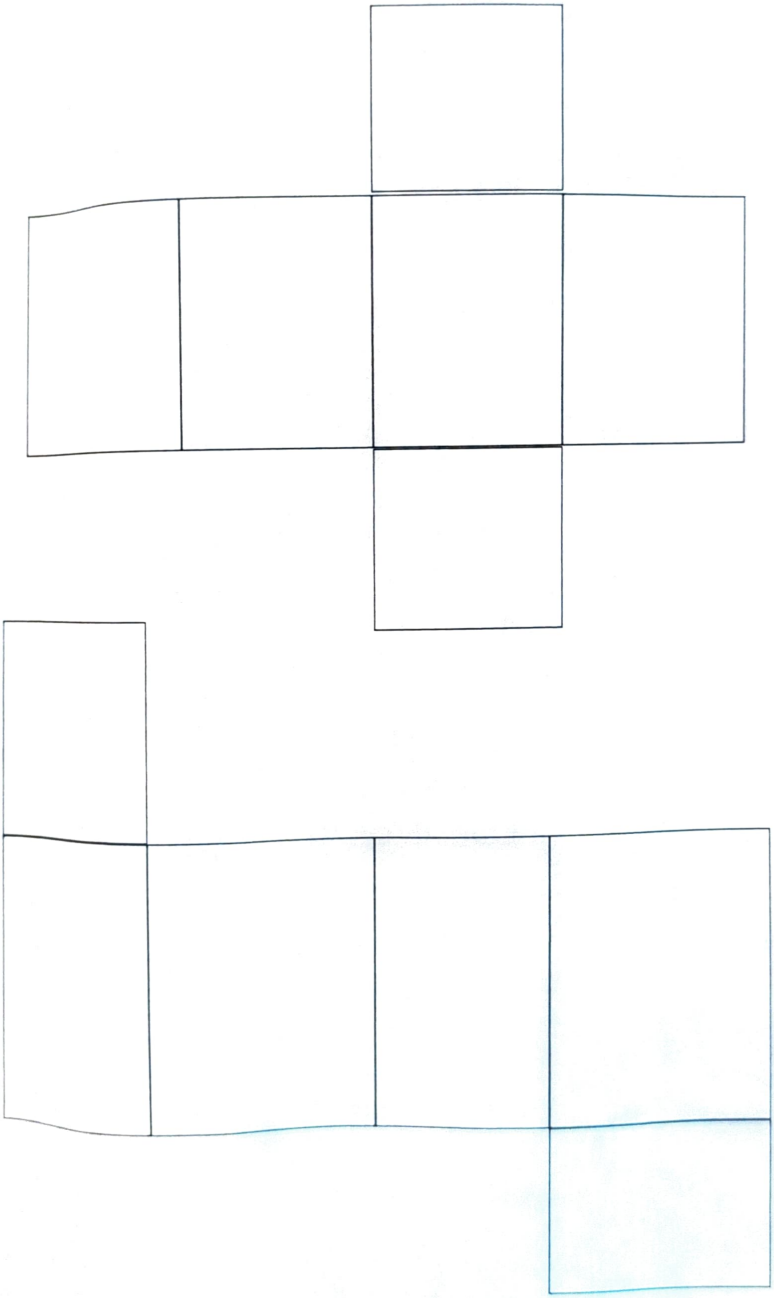
Event	Product(s)	Group Skills	Work Skills
Lesson 4–1: *Resumé*			
Lesson 4–2: *Presentation Event*			

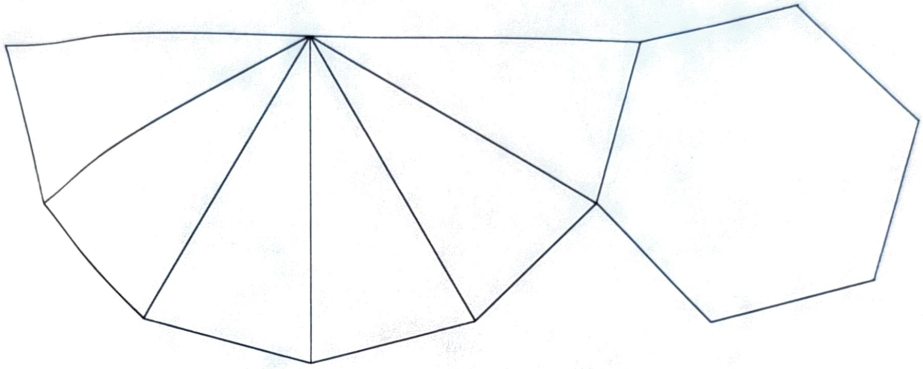
Student _____

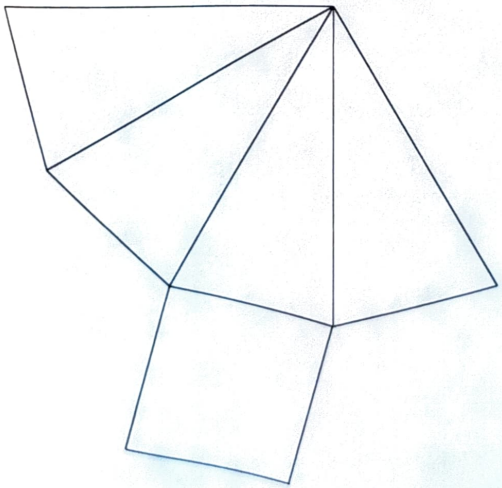
Objectives-Based Record Keeping Chart

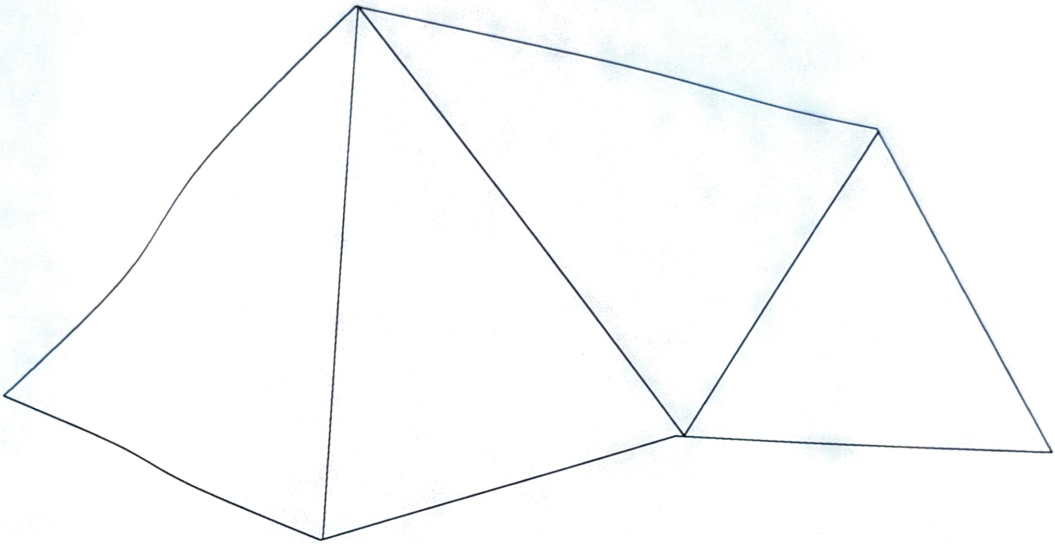
Dates Observed	Objectives
	P–5. works both independently and in a group situation
	P–13. knows what information is extraneous
	P–24. monitors the process in carrying out the plan
	P–26. determines if the answer is reasonable
	P–27. discusses the solution process with others
	P–31. alters the problem and finds the effect

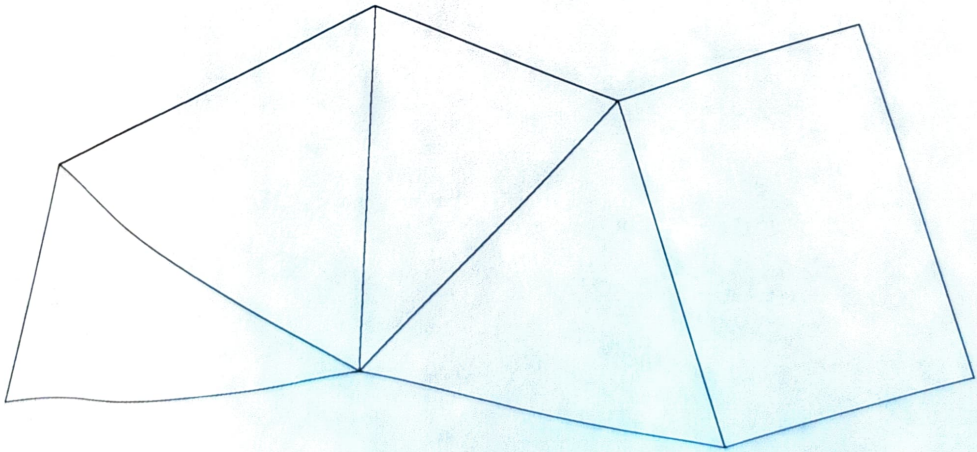


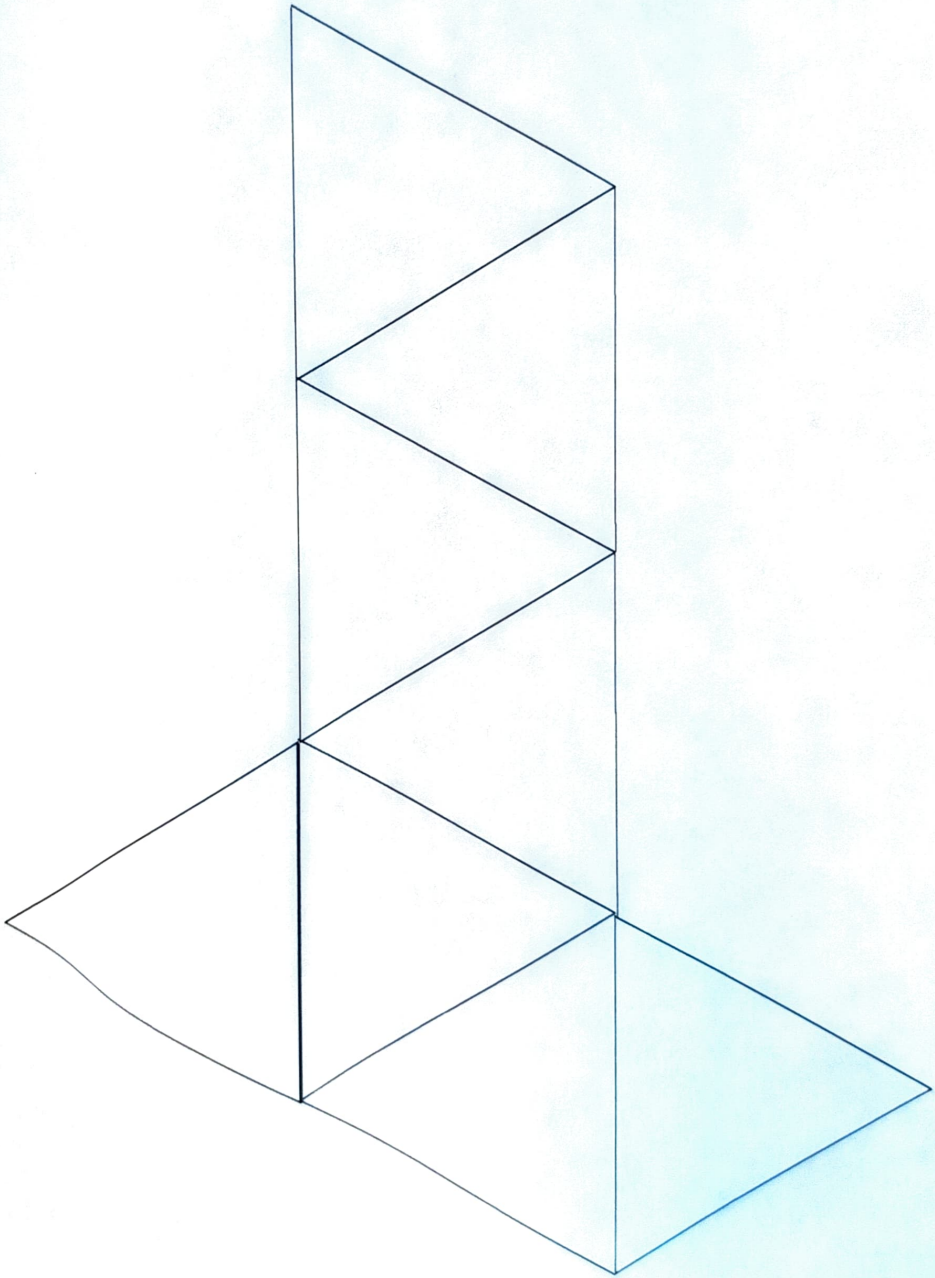


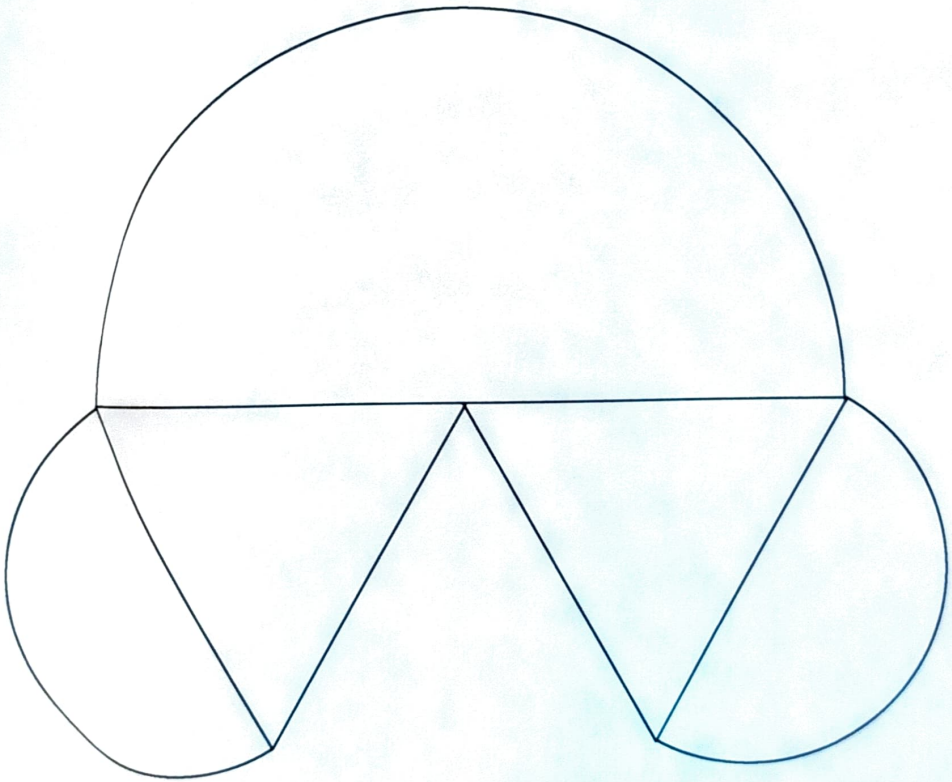












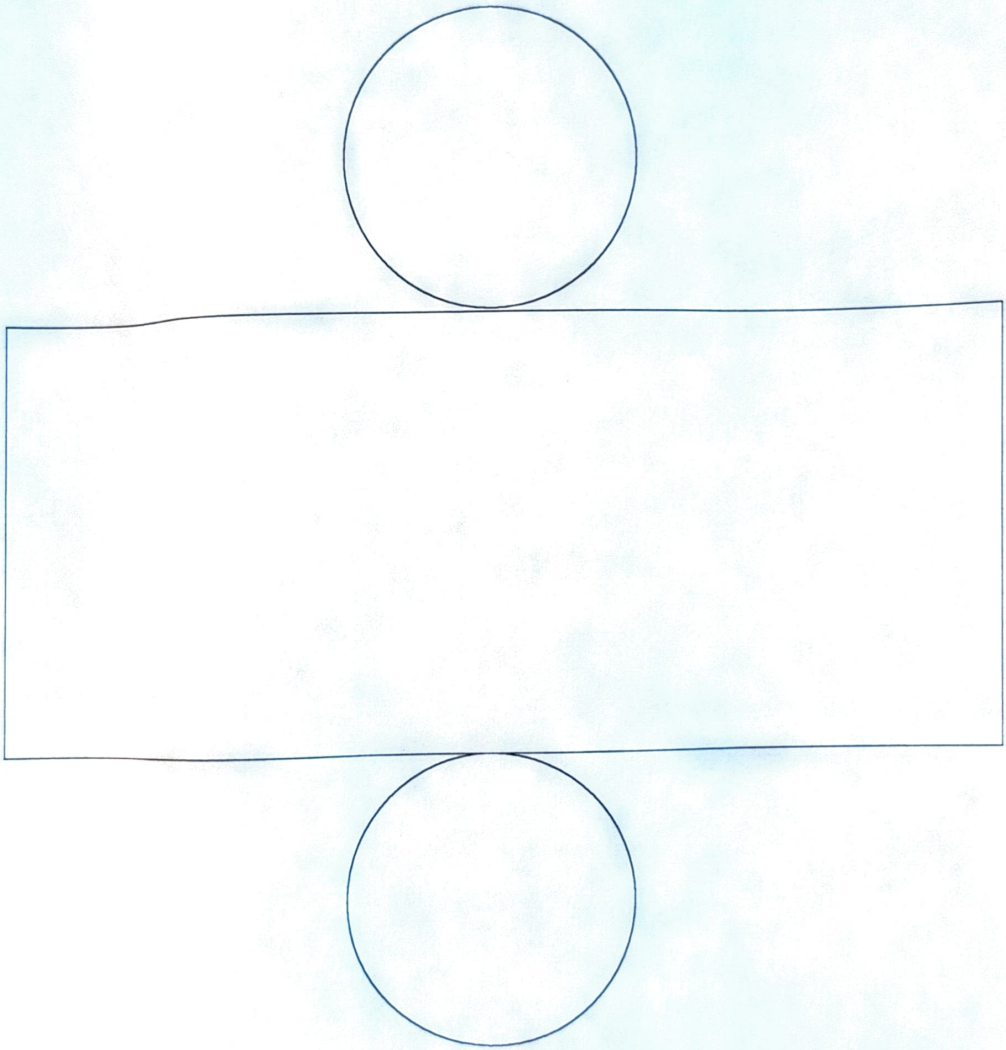


Chart of Bullets

Common Name	Metric Name	Picture(s) of Bullets	Type of Firearm	Data on Firearm
22			Usually a rifle, but some hand guns too	"Twenty-two"
243			rifle	Was often used for "varmit" hunting
270	7		rifle	high powered big game hunting rifle but the bullet itself is rather small
30			rifle	e.g., "30–30," most famous model was the *Winchester Carbine 66* (1866)
320	8		rifle	32 Remington
38			revolver	9 mm Luger 38 Smith & Wesson
44			revolver	44 Magnum
45			revolver	Colt 45 — the gun that "tamed the wild frontier."